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NRDC Comment on Climate Recommendations for Fisheries and Protected Resources

To Ms. Sagar and the National Oceanic and Atmospheric Administration (NOAA):

The Natural Resources Defense Council has a decades-long history of working to promote sustainable fisheries management and safeguard protected resources. A key part of our work is ensuring that fisheries, marine mammals, sharks, and the ecosystems they depend on are protected from the worst effects of climate change.

We submit this comment in response to NOAA's Request for Information on Recommendations for More Resilient Fisheries and Protected Resources Due to Climate Change. 86 Fed. Reg. 12,410 (Mar. 3, 2021). NRDC welcomes the emphasis on climate-ready marine resources in section 216(c) of the *Executive Order on Tackling the Climate Crisis at Home and Abroad* (EO 14,008), issued on January 27, 2021, and we are eager to see NOAA provide much-needed leadership in updating science and management to keep pace with our rapidly changing ocean.[1]

NRDC appreciates the opportunity to provide detailed recommendations on ways NOAA can accelerate the transition to climate-ready fisheries and climate resilience for protected resources. This includes: strong implementation of existing core conservation requirements, expanding the production and use of climate-related science and data, integrating climate considerations throughout the management process, continuing to advance ecosystem-based fisheries management, developing new tools to protect marine mammals from the effects of climate

[1] Please note that NRDC has submitted separate comment letters for sections 216(a) and 216(c) of the Executive Order. For our comments on section 216(a), please see our letter titled "Recommendations for More Resilient Fisheries and Protected Resources Due to Climate Change: Information on 30x30," submitted to oiea@ios.doi.gov and OceanResources.Climate@noaa.gov on April 2, 2021.

change, and improving use of existing laws to conserve sharks. We provide our key recommendations below.

I. NOAA Must Account For Climate Change Throughout Fisheries Management.

A. Climate-Driven Changes Are Profoundly Affecting Our Fisheries.

Climate change is rapidly altering our oceans. As the marine environment grows warmer, more acidic, and lower in oxygen, fish populations are shifting in response. Some fish stocks are moving away from their former habitats to cooler, more hospitable waters. Other populations that are less able to move or adapt are declining altogether.[2] In many cases, climate change imposes new stressors — more frequent extreme events, altered trophic relationships, and disrupted timing cycles — on fish populations that are already stressed by fishing. The combined effect of these stressors reduces the resilience of fish populations, making them more susceptible to breakdowns.[3]

Shifting and declining fish populations have profound impacts on our nation's fisheries. Along the Atlantic coast, two-thirds of fish stocks have shifted north or to deeper waters over the past forty years.[4] Summer flounder used to be abundant along the coast of North Carolina, but the population has moved north and can now be found in abundance off Long Island and even Martha's Vineyard.[5] As a result, fishing families from North Carolina must choose between losing their traditional livelihood or travelling hundreds of miles north in pursuit of summer flounder.[6] If climate change continues at its current rate, fish will continue to move further from

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[2] *See* Intergovernmental Panel on Climate Change, Special Report on the Ocean and Cryosphere in a Changing Climate, Chapter 5: Changing Ocean, Marine Ecosystems, and Dependent Communities, at 450-451 (2019), *available at* https://www.ipcc.ch/site/assets/uploads/sites/3/2019/11/09_SROCC_Ch05_FINAL-1.pdf.

[3] *See, e.g.*, Julia L. Blanchard et al., *Potential Consequences of Climate Change for Primary Production and Fish Production in Large Marine Ecosystems*, 367 Phil. Trans. Royal Soc'y 2979 (2012) (reduced productivity); William E. Bradshaw & Christina M. Holzapfel, *Evolutionary Response to Rapid Climate Change*, 312 Science 1477 (2006) (changed phenology for many species); Steffen U. Pauls et al., *The Impact of Global Climate Change on Genetic Diversity Within Populations and Species*, 22 Molecular Ecol. 925 (2013) (impacts of climate change on intraspecific genetic diversity); Emma Fuller et al., *The Persistence of Populations Facing Climate Shifts and Harvest*, 6 Ecosphere 1 (2015) (finding that "the more quickly the environment shifts, the less harvesting it takes to drive the population extinct").

[4] Janet A. Nye et al., *Changing Spatial Distribution of Fish Stocks in Relation to Climate and Population Size on the Northeast United States Continental Shelf*, 393 Mar. Ecol. Prog. Series 111 (2009); *see also* Malin L. Pinsky et al., *Marine Taxa Track Local Climate Velocities*, 341 Science 1239 (2013).

[5] *See* Nye et al. (2009), supra note 4; Northeast Fisheries Science Center, 66th Northeast Regional Stock Assessment Workshop Assessment Report, at 67-68 (April 2019); Charles T. Perretti & James T. Thorson, *Spatio-Temporal Dynamics of Summer Flounder (Paralichthys dentatus) on the Northeast U.S. Shelf*, 215 Fisheries Res. 62 (2019).

[6] *See, e.g.*, Maurice Tamman, *Fleeing Fish, Upended Lives: Climate Change Spurs an Undersea Exodus—and Tumult on Land*, Reuters Investigates (Oct. 30, 2018), https://www.reuters.com/investigates/special-report/ocean-shock-flounder.

their former habitats. Scientists predict that some species of North American fish will have moved up to 1,000 miles by the end of the century.[7]

Warming waters have also reduced the productivity of some fish stocks, causing fisheries to decline or collapse entirely. New England's lobster fishery once extended south to Connecticut and Rhode Island, but populations in the southern region have collapsed.[8] Meanwhile, New England's Atlantic cod populations have experienced an overall collapse, driven by decades of overfishing and exacerbated by warming waters.[9]

In the Pacific region, climate change and other factors have negatively affected fisheries. The Pacific cod fishery in the Gulf of Alaska, once worth $100 million annually,[10] has drastically declined over the past several years due to a marine heat wave known as "the Blob." Significantly warmer waters placed physiological stress on cod and disrupted their food web.[11] These stressors devastated the cod population and led to seasonal closure of the federal cod fishery in 2020.[12] Generally along the Pacific coast, fishery landings and revenue have declined, and the diversity of species landed has also decreased.[13] Pacific hake made up 70 percent of the landings in 2019, while commercial landings for coastal pelagic finfish, most groundfish, highly migratory species, and salmon are some of the lowest that have been seen in the past several decades.[14] Total revenue from all West Coast fisheries decreased 20 percent from 2018 to 2019.[15]

These trends mirror those occurring elsewhere in the ocean. Long-term projections from the United Nations' Intergovernmental Panel on Climate Change show that ocean warming will continue, the ocean will become increasingly acidic, and the oxygen and nutrient balance will continue to be disrupted.[16] Responding to these conditions, species will shift their ranges, the

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[7] *See* James W. Morley et al., *Projecting Shifts in Thermal Habitat for 686 Species on the North American Continental Shelf*, 13 PLoS ONE e0196127 (2018).
[8] *See, e.g.*, Penelope Howell et al., *Long-Term Population Trends in American Lobster (Homarus americanus) and Their Relation to Temperature in Long Island Sound*, 24 J. Shellfish Res. 24 (2005).
[9] *See, e.g.*, Andrew J. Pershing et al., *Slow Adaptation in the Face of Rapid Warming Leads to Collapse of the Gulf of Maine Cod Fishery*, 350 Science 809 (2015).
[10] Steven Barbeaux et al., *Assessment of the Pacific Cod Stock in the Gulf of Alaska*, North Pacific Fishery Management Council, Gulf of Alaska Stock Assessment and Fishery Evaluation, at 189-332 (Nov. 2017 council draft), https://www.afsc.noaa.gov/refm/stocks/plan_team/2017/GOApcod.pdf.
[11] *Id.*
[12] Kavitha George, *Alaska Cod Fishery Closes and Industry Braces for Ripple Effect*, NPR (Dec. 8, 2019), https://www.npr.org/2019/12/08/785634169/alaska-cod-fishery-closes-and-industry-braces-for-ripple-effect.
[13] Northwest Fisheries Science Center, NOAA Tech. Memo. NMFS-NWFSC-160, *Ecosystem Status Report of the California Current for 2019-20: A Summary of Ecosystem Indicators Compiled by the California Current Integrated Ecosystem Assessment Team (CCIEA)*, at xi, 59-61 (October 2020) ("Ecosystem Status Report").
[14] *Id.*
[15] *Id.*
[16] Intergovernmental Panel on Climate Change (2019), supra note 2, at 450-51.

composition of ecosystems will change, and the productivity of many fish stocks will continue to decline.[17]

B. Implementation of the Magnuson-Stevens Act Must Remain Strong.

The unique system of stakeholder-driven, science-based fishery management embodied in the Magnuson-Stevens Fishery Conservation and Management Act (MSA) has had notable success, both in improving the health of fish populations and in providing more stability to the commercial and recreational fishing industries. Requirements in the MSA to (1) prevent overfishing with science-based catch limits (which may not exceed recommendations of the scientific and statistical committees) and accountability measures,[18] and (2) rebuild overfished stocks in a timeframe that is as short a time as possible and not to exceed 10 years (with certain exceptions)[19] have resulted in the number of stocks subject to overfishing being cut by more than half and the successful rebuilding of 47 once-overfished fish stocks to date.[20] As NOAA Fisheries has recognized, these foundational components of sustainable management are central to managing fisheries in a changing climate.[21]

Climate change impacts on marine species do not act independently from other stressors, such as fishing, and overfished populations are even more vulnerable to climate-induced decline or even collapse.[22] Scientists recommend that the most important preparation for such changes that fishery managers can undertake is to ensure that fisheries are well-managed to promote resilient and abundant fish stocks; this will require a continued focus on sustainable catch levels and a strong rebuilding policy.[23] Weakening the implementation of the proven science-based management system risks exacerbating the negative impacts of climate change on fish stocks and ultimately harming the viability of the fisheries they support.

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[17] *Id*. at 450-52. *See also* Malin L. Pinsky et al., Preparing Ocean Governance for Species on the Move, 360 Science 1189 (2018); Wendy E. Morrison & Valerie Termini, *A Review of Potential Approaches for Managing Marine Fisheries in a Changing Climate*, NOAA Tech. Memo. NMFS-OSF-6 (Nov. 2016); Lauren A. Rogers et al., Shifting Habitats Expose Fishing Communities to Risk Under Climate Change, 9 Nature Clim. Chg. 512 (2019); Elvira S. Poloczanska et al., *Global Imprint of Climate Change on Marine Life*, 3 Nature Clim. Chg. 919, 923 (2013); Heike K. Lotze et al., *Global Ensemble Projections Reveal Trophic Amplification of Ocean Biomass Declines with Climate Change*, 116 Proc. Nat'l Acad. Sci. 12,907 (2019).

[18] 16 U.S.C. § 1852(h)(6); 1853(a)(15).

[19] 16 U.S.C. § 1854(e)(4)(A).

[20] NOAA Fisheries, *Status of Stocks 2019: Annual Report to Congress on the Status of U.S. Fisheries* (July 2020).

[21] Melissa A. Karp et al, *Accounting for Shifting Distributions and Changing Productivity in the Fishery Management Process: From Detection to Management Action*, NOAA Tech. Memo. NMFS-F/SPO-188 (Nov. 2018).

[22] *See, e.g.*, Malin L. Pinsky and David Byler, *Fishing, fast growth and climate variability increase the risk of collapse*, 282 Proc. of Royal Soc. B. 1813 (2015), Richard J. Bell et al., *Rebuilding in the Face of Climate Change*, 75 Can. J. Fish. Aquat. Sci. 1405 (2018).

[23] *See, e.g.*, Christopher M. Free et al., *Impacts of Historical Warming on Marine Fisheries Production*, 363 Science 979 (2019).

We caution NOAA Fisheries about use of the term “depleted” to describe fisheries designated as “overfished.” Although, as we understand it, no substantive change to the MSA’s requirements to prevent overfishing or rebuild overfished stocks is intended by the use of “depleted,” we remain concerned that more widespread substitution of this term could place additional pressure on fishery managers and make it harder for them to compel reductions in fishing mortality at the outset of and throughout a rebuilding plan.[24] In 2016, NOAA Fisheries previously considered adding the term “depleted” to National Standard 1 guidelines in order “to describe those stocks whose biomass has declined as a result of habitat loss and other environmental conditions, rather than fishing pressure.”[25] The agency decided against this course of action because of the difficulty in distinguishing between environmental and fishing impacts on a stock. The agency chose instead to maintain the requirement that all stocks whose biomass declines below minimum stack size threshold (MSST) are considered to be overfished, regardless of the factors responsible for that decline. The agency also noted that councils have the authority to “use the term ‘depleted’ to further describe the status of an overfished stock that has been impacted to some extent by environmental factors in addition to (or in the absence of) fishing pressure.”[26] We agree with NOAA’s reasoning and the option to use “depleted” when necessary, to provide additional context regarding a stock’s overfished designation, but not as a substitute for that status.

C. Fisheries Science Must Be Modernized.

Supported by strong science, the U.S. fisheries management system has been regarded as among the world’s best. However, fisheries scientists now face a significant challenge. The substantial changes we are witnessing in marine ecosystems are challenging to fisheries science because it has traditionally relied heavily on the notion that the past helps predict the future. As climate change begins to impact patterns of fish abundance and their geography, the historical record of observations can become less useful and lead to erroneous, or uncertain, predictions.

Constrained by existing science capacities, NOAA Fisheries struggles to track fish movements, predict the productivity of valuable fisheries, and forecast the timing of the next marine heat wave. To ensure NOAA Fisheries can achieve its mandates under changing climate conditions (including the Magnuson-Stevens Act’s fishery conservation and management requirements.) and enhance the resilience of living marine resources and dependent economies, the Biden Administration must provide increased financial support to NOAA’s fisheries science mission as we detail below.

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[24] There have been several legislative proposals to formally replace the term “overfished” with “depleted” under the Magnuson-Stevens Act, and NRDC has raised similar concerns to policy makers in this context.
[25] NOAA Fisheries, Magnuson-Stevens Act Provisions; National Standard Guidelines, 81 Fed. Reg. 71,858, 71,859 (Oct. 18, 2016).
[26] *Id.*

To operationalize climate ready fisheries, the Administration will need to make three key science investments: the Climate and Fisheries Initiative, enhanced research and monitoring of fish populations, and expanded use of decision support tools.

Climate and Fisheries Initiative: NOAA has publicly said that it aims to modernize fisheries science and deliver ocean-climate forecasts on time scales that are useful to fishermen and living marine resource managers. To do so, NOAA has proposed establishing interdisciplinary research hubs in each major fishery region. These research collaboratives will connect NOAA's climate modeling enterprise with the agency's fisheries labs, and they will provide three key functions: regional-scale ocean forecasts over a time period useful to marine resource managers and ocean-based industries, climate-informed forecasts of fisheries and marine species of interest, and establishing decision support tools, such as risk assessments, to help managers integrate forecasts into decision making. The proposed approach would serve as a major turning point for NOAA Fisheries in its ability to provide robust advice in the face of climate change.

The proposed Climate and Fisheries Initiative could provide key services to coastal communities and ocean-based industries beyond fisheries. Science products include early warning services for extreme events (e.g., marine heatwaves, harmful algae blooms, and episodes of low pH waters), climate informed stock assessments, predictions of regional circulation patterns, and regional predictions regarding melting sea ice and sea level rise. Beneficiaries of these services would include regional fishery management councils, interstate and state marine resource agencies, fishing and aquaculture industries, and their dependent businesses and coastal communities.

Enhanced Monitoring: NOAA Fisheries monitors fish abundance with regular, fishery-independent surveys. These in-the-water observations are important indicators of fishery health and are essential inputs to fishery forecasts. With our fisheries in a state of flux, the agency's survey coverage is currently inadequate. We recommend that NOAA Fisheries evaluate the current survey design considering climate-induced range shifts. The agency should expand routine trawl surveys and cooperative research programs to fill data gaps. Growing cooperative research programs will help support coastal economies by creating jobs and giving fishermen a role in building the industry's resilience to climate change.

Decision Support Tools: To integrate climate-relevant forecasts into management decisions, NOAA will need to promote greater use of decision support tools such as management strategy evaluation (MSE), risk assessment, and scenario planning. This will require dedicated teams of scientists located at each science center who work on the interface of fish forecasting and management.

D. Accounting for Climate Change Must Be A Key Part of Fisheries Management.

Climate-driven shifts in the distribution and productivity of our fish populations pose significant challenges for fisheries management. These challenges include reduced accuracy of scientific predictions, lack of preparation for extreme events, the decline of existing stocks and emergence of new stocks, conflicts over catch allocation, and challenges in coordination across different jurisdictions. Although none of these management challenges are entirely new, they will increase in prevalence and magnitude as climate change pushes more fisheries to shift and decline. If NOAA does not proactively address climate-driven management challenges, we expect to see increasing unregulated fishing and mounting confusion and conflict over stock boundaries. Ultimately, the nation's fisheries, fishing communities, and consumers will suffer the consequences of a management system that does not evolve with our changing climate.

Although fishery scientists, managers, and fishermen generally recognize the need to advance "climate-ready" management approaches, the framework implementing the MSA currently lacks any mention of climate change, and fishery management councils lack clear guidance on how climate change should be integrated into the management process. The agency has taken initial steps in this direction with technical memoranda,[27] but further, more granular, guidance is needed for Councils and regional offices to actually operationalize climate-ready fisheries management.

The MSA provides NOAA Fisheries and the Councils with broad authority to deploy new measures to manage fisheries for climate change, which can be implemented through targeted, climate-specific revision of NOAA's regulations, as well as new guidance and technical memoranda. We outline below our suggestions for revising the MSA's management process.

1. Climate change science must be an integral part of the management process.

NOAA Fisheries must ensure that science accounting for the effects of climate change is woven throughout the entire management process. Achieving this end will require that scientific research on climate change guides management decisions, that Councils explicitly consider the effects of climate change, and that Council members are trained on best practices to manage fisheries for climate change.

NOAA Fisheries should ensure that its research related to climate change is ultimately translated into measures councils can use to manage stocks. For example, NOAA Fisheries has conducted climate vulnerability assessments for certain Northeast fish stocks, Bering Sea fish stocks, and Pacific salmon, which provide useful information about how climate change might affect those

[27] *See* Karp et al. (2018), *supra* note 21; Morrison & Termini (2016), *supra* note 17.

stocks, but do not recommend how these factors should influence decision making and the evaluation of risk.[28] NOAA Fisheries providing specific recommendations would assist councils in ensuring that stocks under their jurisdiction are well-managed for climate change.

Fishery management councils and scientific and statistical committees (SSCs) must also incorporate up-to-date climate science throughout the management process. While these bodies on occasion account for factors linked to climate change when making management decisions – such as the effects of changing ocean temperatures, ocean upwellings, and forage availability on stocks[29] – evaluation of these factors, even if qualitative, should be a required part of fisheries management and there should be consistency across all U.S. management regions when considering such factors.

NOAA Fisheries has the authority to issue comprehensive guidance to the councils and their SSCs on best practices for incorporating climate change science into the management process.[30] Such guidance should include, at a minimum: requiring SSCs to explicitly consider the effects of climate change on a fishery; guidance on climate-informed stock assessments; the potential role of management strategy evaluations (MSEs) in evaluating management options under different climate scenarios; and guidance on setting catch limits for data-limited and data-poor stocks. Instances where it is essential to use such science in the management process are discussed in greater detail below.

Further, fishery managers should be regularly trained on best practices to manage fisheries for climate change. New council members already receive some training on how to manage fisheries in the context of climate change, which includes: an overview of how climate change affects fisheries and covers useful management strategies (e.g., robust stock assessments, ecosystem-based fisheries management, adjusting catch limits as abundances change, and management strategy evaluation).[31] NOAA Fisheries should continue such training for all new council members and extend climate-specific training to all current council members.

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[28] NOAA Fisheries, *Climate Vulnerability Assessments,* https://www.fisheries.noaa.gov/national/climate/climate-vulnerability-assessments.

[29] *See, e.g.*, Pacific Fishery Management Council, *Status of the Pacific Coast Coastal Pelagic Species Fishery and Recommended Acceptable Biological Catches*, at 81 (Dec. 2020) ("2020 CPS SAFE Document"), *available at* https://www.pcouncil.org/documents/2021/01/2020-cps-safe-december-2020.pdf.

[30] *See, e.g.*, 16 U.S.C. §§ 1852(g)(1)(A), 1852(g)(1)(B).

[31] *See, e.g.*, Jay Peterson et al., NOAA Fisheries, *Climate Considerations in Fisheries Management* (Oct. 22, 2020) (training slides), *available at* https://s3.amazonaws.com/media.fisheries.noaa.gov/2020-10/Climate%20in%20Fisheries%20Oct2020%20NCMT%20course_PDF%20final.pdf.

2. NOAA Fisheries and the councils must establish systems to address the challenges posed by shifting stocks.

As climate change causes many fish stocks to shift northward, new commercial fisheries will open up in new areas, while fisheries ramp down in others, raising questions including: the sustainability of existing harvest limits and allocations, the effectiveness of inter-council and international coordination, and data collection and information sharing needs. NOAA Fisheries and the councils will need to establish systems to address these cross-cutting challenges.

a. Emerging fisheries must be managed "smart from the start."

Climate change can give rise to "emerging fisheries" – species may be new to an area, or previously untargeted (sometimes in association with the decline of a historically targeted stock)[32] – which can create conservation and other challenges where a newly-targeted stock is unmanaged.

Fishery managers and researchers agree that the most precautionary pathway is to prevent fishing an emerging fishery until the sustainability of a fishery has been fully evaluated and the species is added to a management framework.[33] This system is informally known as a "red light"

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[32] *See, e.g.*, Malin Pinsky & Nathan Mantua, *Emerging Adaptation Approaches for Climate-Ready Fisheries Management, 27* Oceanography 147, 151 (2014) ("In the United Kingdom, for example, growth in populations of sea bass (Dicentrarchus labra), red mullet (Mullus barbatus), John dory (Zeus faber), anchovy (Engraulis encrasicolus), and squid associated with warming temperatures sparked new fisheries for these species."); Steven Gaines et al., *Improved Fisheries Management Could Offset Many Negative Effects of Climate Change*, 4 Science Adv. eaao1378, at 5 (2018); Press Release, Mid-Atlantic Fishery Management Council, *Council Approves Chub Mackerel Management Measures* (Mar. 11, 2019), *available at* https://www.mafmc.org/newsfeed/2019/council-approves-chub-mackerel-management-measures.

[33] *See, e.g.*, Cal. Fish & Game Code § 7090(e) (providing a 3-year evaluation period for emerging fisheries, in which limited fishing as well as research is conducted to gather essential fishery information); Pinksy & Mantua (2014), *supra* note 32, at 150-51 (recommending a "[t]emporary moratorium on new fisheries," along with "carefully monitored experimental fishing" and government research); E. Pikitch et al., Lenfest Forage Fish Task Force, *Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs* 89-90 (2012) (recommending for low-information stocks that no new fisheries be permitted until adequate information is gathered), *available at* https://www.lenfestocean.org/~/media/legacy/Lenfest/PDFs/littlefishbigimpact_revised_12june12.pdf; Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, Art. 6(6), 2167 UNTS 88 (1995) (providing a general obligation of precautionary management measures for exploratory fisheries, until sufficient data exists to understand the impacts of the fishery); Declaration Concerning the Prevention of Unregulated High Seas Fishing in the Central Arctic Ocean (Oslo, 2015) (providing interim measures to prevent unregulated fishing in the Arctic Ocean, while allowing research fishing); Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean (Ilulissat, 2018) (prohibiting directed fisheries in the Arctic for 16 years, to allow time for information gathering); Convention on the Conservation of Antarctic Marine Living Resources, Art. II (providing a precautionary framework for development of new fisheries in the Southern Ocean, in which full-scale fishing is prohibited but experimental fishing is permitted for purposes of gathering information); Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean, Art. 22 (2009) (creating a red-light system for new fisheries, which allows fishing only after "cautious preliminary conservation and management measures" are put in place).

approach – targeting an emerging fishery is prohibited by default, until further evaluation authorizes a "green light" to fish.

A few councils have already taken similar protective measures for certain unmanaged species. For example, the Pacific Fishery Management Council has taken precautionary measures to prevent directed fishing of certain unmanaged forage fish, including round herring and thread herring, to "proactively protect" such species "until the Council has had an adequate opportunity to both assess the scientific information relating to any proposed directed fishery and consider potential impacts to existing fisheries, fishing communities, and the greater marine ecosystem."[34] The Mid-Atlantic Fishery Management Council has also taken similar measures to prevent fishing of certain forage species.[35] Yet, with the potential for other unmanaged species to be targeted, a new systemic approach is required to ensure fisheries are managed sustainably.

NOAA Fisheries could strengthen the regulations implementing the "list of fisheries" to establish a more rigorous "red light" system.[36] Under existing law, the most protective approach would be to identify "managed" fishing activity on the species-level, ensuring that only actively managed federal fisheries (or comparably managed state or interstate fisheries) are on the list; identify the geographic range of such species; and prohibit fishing on unlisted species (or species outside of the identified geographic boundaries). Regulations should also require the councils to revise the list of fisheries regularly. Other types of revisions may also be needed, such as a more detailed listing of the species caught with particular gear. Legislative revisions may ultimately be needed to establish a fully protective "red light" system, since under existing law, new gear or fishing a new stock would be allowed after a written 90-day notice to the appropriate council or NOAA.[37]

NOAA Fisheries will also need to develop a process to bring unmanaged species into the management regime. This could be done through authorizing experimental fishing on unmanaged species, which would enable data collection and economic scoping of potential fisheries.[38] After sufficient data collection and analysis, a species could be added to the list of fisheries.

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[34] Pacific Fishery Management Council, *Ecosystem Workgroup Report on Unmanaged Forage Fish Protection Final Action* (Mar. 2015) ("PFMC EWG Report"), https://www.pcouncil.org/documents/2015/03/agenda-item-e-4-b-ewg-report.pdf; *see also* 50 C.F.R. §§ 660.5-660.6 (implementing regulations).
[35] *See* Mid-Atlantic Fishery Management Council, Unmanaged Forage Omnibus Amendment, https://www.mafmc.org/actions/unmanaged-forage.
[36] *See* 16 U.S.C. § 1855(a); 50 C.F.R. § 600.725(v).
[37] *See* 16 U.S.C. § 1855(a)(3).
[38] Experimental fishing could be authorized through the use of exempted fishing permits. *See* 16 U.S.C. § 1867(d); 50 C.F.R. § 600.745.

b. NOAA Fisheries and the Councils need to enhance jurisdictional coordination.

Climate-driven shifts will exacerbate the challenges of coordinating fisheries management across different jurisdictions. When a fishery extends across multiple management regions, the region that historically had the most abundant stock will sometimes act as the lead regulator for all regions.[39] If the fishery's center of abundance shifts, conflicts may arise between councils over management responsibility.[40]

Coordination challenges may arise several ways. Stocks may be under management by one council, but shift into regions where councils lack a management plan for that stock – as was the case with blueline tilefish, which was historically managed by the South Atlantic Council, but not by the Mid-Atlantic Council.[41] In the 2010s, commercial vessels moved north and targeted the species in the Mid-Atlantic region, ultimately prompting an emergency rule by NOAA Fisheries limiting catch, until the Mid-Atlantic Council added the species to one of its fishery management plans (FMPs).[42] In addition, stocks may be managed across several council regions, but conflict can arise where shifting stocks call the existing management structure and lead council authority into question. For example, this occurred with summer flounder, scup, and black sea bass, whose management has been led by the Mid-Atlantic Council, but due to stock shifts, prompted a petition by the New England Council seeking joint management authority.[43]

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[39] For example, the Mid-Atlantic Council acts as lead regional council for summer flounder, scup, and black sea bass, even though these species also are fished in the New England and South Atlantic regions. *See* 50 C.F.R. § 600.725(v).

[40] One example of this is when summer flounder and black sea bass populations shifted northward, the New England Council requested joint management authority alongside the Mid-Atlantic Council. *See* Letter from Thomas A. Nies, Executive Director, New England Fishery Management Council, to John Bullard, Regional Administrator, NMFS/NOAA Fisheries (July 5, 2016) (requesting joint management, citing climate change as primary reason).

[41] *See* South Atlantic Fishery Management Council, Snapper-Grouper Fishery Management Plan, https://www.fisheries.noaa.gov/management-plan/south-atlantic-snapper-grouper-fishery-management-plan; *see also*, NOAA Fisheries, Fact Sheet: NOAA Fisheries Proactive Approach to Climate Change, https://www.st.nmfs.noaa.gov/Assets/ecosystems/climate/documents/ClimateFactsheet_Final.pdf; South Atlantic Fishery Management Council, Fishery Ecosystem Plan II: South Atlantic Climate Variability and Fisheries (Mar. 2018), https://safmc.net/uncategorized/fepii-south-atlantic-climate-variability-and-fisheries-march-2018.

[42] *See* Southeast Data, Assessment, and Review, *SEDAR 32 Stock Assessment Report: South Atlantic Blueline Tilefish* (2013) (finding South Atlantic stock overfished), *available at* https://sedarweb.org/docs/sar/S32_SA-BLT_SAR_FINAL_11.26.2013.pdf; 80 Fed. Reg. 31,864 (June 4, 2015) (emergency rule); Mid-Atlantic Fishery Management Council, *Golden and Blueline Tilefish*, https://www.mafmc.org/tilefish.

[43] *See generally*, Mid-Atlantic Fishery Management Council, *Fishery Management Plan for the Summer Flounder Fishery* (Oct. 1987), *available at* https://www.mafmc.org/sf-s-bsb; Mid-Atlantic Fishery Management Council, Omnibus Amendment at 34-36 (July 2011) (summarizing history of summer flounder, scup, black seabass FMP); NOAA Fisheries, *Species Directory: Summer Flounder*, https://www.fisheries.noaa.gov/species/summer-flounder#resources; Letter from Thomas A. Nies to John Bullard, *supra* note 40; Letter from David E. Pierce, Director, Massachusetts Division of Marine Fisheries, to E.F. "Terry" Stockwell, Chairman, New England Fishery Management Council (June 10, 2016) (urging New England Council to request joint management; detailing climate change rationale).

While there are some systems in place for developing fishery management plans when a fishery extends beyond a single council's jurisdiction,[44] there is a need for more nimble and transparent coordination systems if, for example, large population swings from year to year occur, or if fish shift their ranges more rapidly over time. NOAA Fisheries should revise its guidelines to provide a set of conditions triggering the process for council coordination to address shifting or straddling stocks, as well as a process for decoupling management when a stock is no longer straddling boundaries.[45] The emerging fisheries framework described above will help address situations where a stock moves into a council region where it is unmanaged.

As fish shift their ranges, it will also be increasingly important to have strong systems for coordination, collaboration, and data sharing with fishery managers in neighboring nations like Canada and Mexico. NOAA Fisheries should support improvement of these systems. For example, certain stocks like the Pacific mackerel range from Canada to Mexico, and continued collaborative research and information exchange between management bodies is crucial to having a full understanding of fishery health.[46] In addition to supporting research into stocks spanning international boundaries, NOAA Fisheries should promote cooperation and collaboration between fishery management councils and international management bodies.

c. NOAA Fisheries may need to revisit allocations policy in light of climate change.

Conflicts over catch allocations will likely increase as fisheries shift with changing climate. When there is high demand and limited access to a fishery, different user groups clash over how much catch each group is entitled to. As a fish population moves across jurisdictions, fishermen whose livelihoods historically depended upon a fishery are understandably reluctant to give up their catch allocations. Meanwhile, if catch allocations do not keep up with shifting stocks, fishermen in receiving regions may be unable to catch and retain newly abundant species of fish in their local waters. Difficult-to-monitor bycatch will likely increase and conflicts over catch allocations may result in non-compliance with fishing regulations[47] or litigation.[48] One example is with summer flounder – the stock has shifted northward in the past several decades, while the

[44] *See* 16 U.S.C. § 1854(f); 50 C.F.R. § 600.105.
[45] NOAA has the authority to do so pursuant to 16 U.S.C. § 1854(f) and could revise the regulations at 50 C.F.R. § 600.110.
[46] *See* 2020 CPS SAFE Document, *supra* note 29, at 81.
[47] For example, in October 2015, a Long Island commercial fisherman was convicted by NOAA's Office of Law Enforcement for violating the Research Set-Aside program and filing false fishing logs in order to land additional summer flounder. *See* NOAA Fisheries, *RSA Scammer Sentenced for 290,000 Pounds of Illegal Summer Flounder* (Oct. 19, 2015), https://www.fisheries.noaa.gov/feature-story/rsa-scammer-sentenced-290000-pounds-illegal-summer-flounder.
[48] *See, e.g.*, New York v. Ross, No. 19-cv-259 (E.D.N.Y. filed July 30, 2019) (challenging allocations for summer flounder).

allocation system has remained relatively static, creating conflicts among the fishermen targeting the species.[49]

While councils are in the process of redefining their allocation policies – through Council Coordination Committee (CCC) and NOAA Fisheries processes, they are defining conditions that trigger an allocation review, which can lead to an FMP amendment[50] – there is still a need for NOAA Fisheries to provide climate change-specific guidance on allocations. Existing NOAA policies and directives on allocations mention climate change only briefly, and do not provide explicit direction on considering climate when setting triggers for reallocation.[51] New guidance on allocations could include: directing the councils to explicitly consider climate change or range shifts in developing their allocation policies, specifying certain conditions requiring reallocation, or requiring certain periodic intervals during which councils need to revisit allocation decisions.

3. Councils must incorporate management measures addressing climate change into fishery management plans.

In addition to creating and enhancing frameworks to address the unique challenges posed by climate change, NOAA Fisheries should ensure that fishery management plans and supporting documents explicitly account for and address the threats posed by climate change.

a. Stock assessments and FMPs must explicitly consider the threats posed by climate change.

NOAA Fisheries has the authority to issue guidance and/or revise regulations requiring councils to analyze the impacts of climate change on the fishery and analyze the vulnerability of the fishery to climate change, as well as require councils to inventory any additional research needed to manage stocks effectively in light of climate change.[52]

A few councils have already started doing this work of their own accord. For example, PFMC's recently-released draft stock assessment and fishery evaluation (SAFE) report for coastal pelagic

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[49] *See, e.g.*, Bradford A. Dubik et al., Governing Fisheries in the Face of Change: Social Responses to Long-Term Geographic Shifts in a U.S. Fishery, 99 Mar. Pol'y 243 (2019); Leslie Kaufman, Bloomberg Green, Climate Change is Reshaping Atlantic Fisheries and Sending this Fluke Fight to Court (Jan. 18, 2020), https://www.bloomberg.com/news/features/2020-02-18/climate-change-is-reshaping-atlantic-fisheries-and-sending-this-fluke-fight-to-court.

[50] *See* National Marine Fisheries Service Policy No. 01-119 (Feb. 23, 2017) (overall process memo); National Marine Fisheries Service Procedural Directive No. 01-119-01 (July 27, 2016) (CCC document setting forth the categories of public input triggers, time triggers, and indicator-based triggers); National Marine Fisheries Service Procedural Directive No. 01-119-02 (July 27, 2016) (agency practices and factors to consider when reviewing and making allocation decisions); https://www.fisheries.noaa.gov/national/laws-and-policies/fisheries-management-policy-directives.

[51] *Id.*

[52] *See, e.g.*, 16 U.S.C. §§ 1852(g)(1)(A), 1853(a)(1)(A), (a)(3), (a)(8).

species (CPS) explicitly considered ecosystem trends and climate change threats in evaluating the status of CPS stocks and appropriate management actions.[53]

b. Population resilience must be addressed in FMPs.

Climate change will be a significant stressor for many fish stocks, with changing ocean conditions, more frequent extreme events, altered trophic relationships, and disrupted timing cycles.[54] Fishing also can be a stressor for fish stocks, by elevating mortality rates and selectively removing individuals from the population.[55] Various researchers have elaborated on the ways that fishing impacts fishery resilience:

- Commercial fishing generally targets large individuals, so harvested populations tend to have smaller and younger fish, on average.[56] The loss of large fish can result in reduced reproductive potential and increased fluctuations in abundance for a population.[57] Large old fish are beneficial because they can have much higher reproductive capacities, higher quality offspring, longer and more flexible spawning seasons, and a greater ability to migrate to suitable habitats.[58] In these ways, the presence of large old females greatly enhances the portfolio effect (i.e., bet hedging) of a population.[59]
- The persistent selection of large individuals from the population can lead to permanent loss of genetic and/or phenotypic variability within a population.[60] Scientists have

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[53] *See* 2020 CPS SAFE Document, *supra* note 29, at 56-64, 93-95.

[54] *See, e.g.,* Intergovernmental Panel on Climate Change (2019), *supra* note 2; Blanchard et al. (2012), *supra* note 3 (reduced productivity); Bradshaw & Holzapfel (2006), *supra* note 3 (changed phenology for many species); Pauls et al. (2013), *supra* note 3 (impacts of climate change on intraspecific genetic diversity).

[55] *See, e.g.*, Benjamin S. Halpern et al., *A Global Map of Human Impact on Marine Ecosystems*, 319 Science 948 (2008); Phoebe A. Woodworth-Jefcoats et al., *Relative Impacts of Simultaneous Stressors on a Pelagic Marine Ecosystem*, 6 Front. Mar. Sci. 383 (2019).

[56] *See* RAY HILBORN & CARL J. WALTERS, QUANTITATIVE FISHERIES STOCK ASSESSMENT: CHOICE, DYNAMICS & UNCERTAINTY 73-74 (1992); David O. Conover & Stephan B. Munch, *Sustaining Fisheries Yields Over Evolutionary Time Scales*, 297 Science 94 (2002).

[57] *See* Robert M. May et al., *Exploiting Natural Populations in an Uncertain World*, 42 Math. Biosci. 219 (1978); M. Hidalgo et al., *Synergistic Effects of Fishing-Induced Demographic Changes and Climate Variation on Fish Population Dynamics*, 426 Mar. Ecol. Prog. Ser. 1 (2011) (showing age truncation leads to greater population swings); Christian N. K. Anderson et al., *Why Fishing Magnifies Fluctuations in Fish Abundance*, 452 Nature 835 (2008) (similar, analyzing CalCOFI data).

[58] *See, e.g.*, Daniel E. Schindler et al., *Population Diversity and the Portfolio Effect in an Exploited Species*, 465 Nature 609 (2010); Joanna R. Bernhardt & Heather M. Leslie, *Resilience to Climate Change in Coastal Marine Ecosystems*, 5 Ann. Rev. Mar. Sci. 371 (2013).

[59] *See, e.g.*, M.D. Bryant, *Global Climate Change and Potential Effects on Pacific Salmonids in Freshwater Ecosystems of Southeast Alaska, 95* Climatic Change 169 (2008) (discussing portfolio effect across Alaska salmon runs).

[60] *See, e.g*., Richard Law, *Fishing, Selection, and Phenotypic Evolution*, 57 ICES J. Mar. Sci. 659 (2000); Fred W. Allendorf et al., *Genetic Effects of Harvest on Wild Animal Populations*, 23 Trends Ecol. Evol. 327 (2008) (reviewing genetic effects of harvest); David O. Conover et al., *Darwinian Fishery Science: Lessons from the Atlantic Silverside (Menidia menidia)*, 62 Can. J. Fish. Aquat. Sci. 730 (2005) (describing evolution in response to fishing in Atlantic silversides); Jeffrey J. Hard et al., *Evolutionary Consequences of Fishing and Their Implications*

documented this effect in many northwest Atlantic groundfish stocks (e.g., Atlantic cod, pollock, and haddock), for example, where reductions in size and age-at-maturity have been measurable since the 1970s.[61] Loss of genetic and phenotypic diversity generally is detrimental to the long-term viability of a population and a species.[62]

- Spatial structure of a population[63] often is studied and starts to be understood only after fishing commences, with the result that fishing mortality can permanently alter stock structure. For example, harvest levels were set for decades for Atlantic cod in the Gulf of Maine on the assumption that a single, well-mixed stock existed.[64] After the 2011 stock assessment found an unexpected crash, scientists began to realize there may have been a number of distinct sub-stocks occupying different areas in the Gulf of Maine, at least several of which may have been extirpated due to poorly-distributed mortality.[65] With a changed metapopulation structure, Gulf of Maine cod is now believed to exhibit less-productive population dynamics.[66]
- Fishing can even alter behavior in a population. For example, one laboratory study induced changes in the willingness to forage of Atlantic silversides, as well as in their response to predation, by repeated harvest of adult individuals.[67] Fishing-induced behavioral changes can affect the resilience of a population by contributing to altered population dynamics (slower growth, smaller age at maturity, etc.) as well as by changing the population's susceptibility to various external threats or stressors.

Federal fisheries management generally is oriented around biomass and yield, and often does not track or regulate the factors that contribute to a population's resilience to stressors, such as age structure or genetic and phenotypic diversity. Status quo management therefore tends to allow, and can contribute to, degraded resilience in fish populations. Given new climate-related stressors, fish populations with degraded resilience are more likely to experience breakdowns—unexpected bad outcomes such as declining abundance, recruitment failure, range contraction,

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for Salmon, 1 Evol. Applic. 388 (2008) (discussing selective pressure on salmon stocks from fishing); Malin L. Pinsky & Stephen R. Palumbi, *Meta-Analysis Reveals Lower Genetic Diversity in Overfished Populations*, 23 Molec. Ecol. 29 (2014).

[61] *See, e.g.*, E. A. Trippel et al., *Changes in Age and Length at Sexual Maturity of Northwest Atlantic Cod, Haddock and Pollock Stocks, 1972-1995*, Can. Tech. Rep. Fish. & Aquat. Sci. No. 2157 (1997).

[62] *See, e.g.*, Katja Enberg et al., *Implications of Fisheries-Induced Evolution for Stock Rebuilding and Recovery*, 2 Evol. Applic. 394 (2009); Esben M. Olsen et al., *Maturation Trends Indicative of Rapid Evolution Preceded the Collapse of Northern Cod*, 428 Nature 932 (2004).

[63] Note that spatial structure in many cases has a genetic element to it, so the dividing line between spatial structure and genetic diversity/structure often is somewhat unclear. *See, e.g.*, Schindler et al. (2010), *supra* note 58 (discussing population variability in sockeye salmon runs, without differentiating cause for variation).

[64] *See, e.g.*, Micah Dean et al., *The Relative Importance of Sub-Populations to the Gulf of Maine Stock of Atlantic Cod*, 76 ICES J. Mar. Sci. 1626 (2019).

[65] *See, e.g., id.;* Tony Kess et al., *A Migration-Associated Supergene Reveals Loss of Biocomplexity in Atlantic Cod*, 5 Sci. Adv. 2461 (2019) (similar finding for cod off Newfoundland/Labrador).

[66] *See, e.g.*, Dean et al. (2019), supra note 64.

[67] *See* Matthew Walsh et al., *Maladaptive Changes in Multiple Traits Caused by Fishing: Impediments to Population Recovery*, 9 Ecol. Letters 142 (2006); *see also* Muriel Mambrini, et al., *Selection for Growth Increases Feed Intake and Affects Feeding Behavior of Brown Trout*, 88 Livest. Prod. Sci. 85 (2004).

reduced yield, or slow rebuilding rates. These breakdowns can be expected to increase in frequency and severity as climate change proceeds and NOAA Fisheries must ensure that FMPs protect population resilience.

In order to protect resilience in managed fisheries, NOAA Fisheries should evaluate the appropriate management strategies to protect population resilience, and develop guidance identifying the relevant factors for resilience (such as age and size, spatial structure, genetics, abundance, and other factors). Because the factors contributing to resilience will vary from species to species, NOAA Fisheries should also require: (1) councils to evaluate resilience in their managed species, (2) SSCs to consider resilience when providing scientific advice to councils, and (3) councils to consider and incorporate measures protecting population resilience in FMPs.[68]

c. FMPs should use climate-based management measures where appropriate.

Councils have broad authority to adjust catch limits and apply management measures to promote the long-term health and stability of a fishery, including measures that account for the effects of climate change.[69] As additional research clarifies the linkages between climate change and population dynamics in managed stocks, NOAA Fisheries and the councils should consider incorporating additional climate-based management measures into fishery management plans.

The Pacific Fishery Management Council provides a few examples of management measures that account for the effects of climate variability. For Pacific sardine, when the fishery is open, allowable harvest is based in part on ocean temperature and its effects on stock recruitment.[70] The swordfish drift gillnet fishery also has a closure rule triggered by an occurring or forecasted El Niño event, in order to prevent loggerhead turtle bycatch.[71]

In many cases, there are other measures that promote long-term fishery health in the face of climate change that could be incorporated into fishery management plans or yearly management actions. For example, in strategizing for how to manage its fisheries for climate change, the State of California considered several strategies: adaptable catch control rules, shifting conservation

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[68] NOAA Fisheries has authority to promulgate such guidelines pursuant to various provisions in the Magnuson-Stevens Act. *See, e.g.*, 18 U.S.C. §§ 1852(g), (h), 1853(a)(1), (a)(3).
[69] *See, e.g.*, 16 U.S.C. § 1853(a)(1)(A); 50 C.F.R. § 600.310.
[70] NOAA Fisheries Northwest/Southwest Science Centers, *Western Regional Action Plan: NOAA Fisheries Climate Science Strategy*, at 21 (Nov. 2016) ("WRAP"), *available at* https://repository.library.noaa.gov/view/noaa/12792; Pacific Fishery Management Council, *Coastal Pelagic Species Fishery Management Plan*, at 39 (June 2019), *available at* https://www.pcouncil.org/documents/2019/06/cps-fmp-as-amended-through-amendment-17.pdf.
[71] *See* WRAP, *supra* note 70, at 21; Pacific Fishery Management Council, *Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species*, at 51 (April 2018), *available at* https://www.pcouncil.org/documents/2018/04/fishery-management-plan-for-west-coast-fisheries-for-highly-migratory-species-through-amendment-5.pdf.

area boundaries as stocks shift, seasonal closures based on shifting ocean temperatures, and more closely linking real-time monitoring with management actions.[72]

E. NOAA Fisheries should continue advancing ecosystem-based fisheries management, including robust protections for fish habitat and forage fish.

Given that climate change is changing whole ecosystems, ecosystem-based fisheries management (EBFM) is a critical part of climate-ready fishery management. EBFM is an integrated approach that considers and accounts for interactions of managed fisheries with other species and promotes resiliency at the ecosystem level.[73] In 2016, NOAA Fisheries began to operationalize EBFM with its release of the EBFM Policy and Road Map, and the subsequent development of Regional Action Plans.[74] NOAA should ramp up implementation of EBFM by reinvigorating management under these existing policy tools. Embracing EBFM principles should go hand-in-hand with more robust use of management strategy evaluation and other decision-making tools, as routine evaluation of management strategies under climate and ecosystem conditions will become increasingly important as conditions shift from historic baselines.

Habitat protection is one important but underutilized ecosystem-based tool for ensuring healthy and climate resilient fisheries.[75] Climate change and ocean acidification are transforming the habitats fish rely on, from coral reefs to seagrasses, and causing shifts in fish-habitat relationships.[76] The MSA requires fishery management councils to designate "essential fish habitat" (EFH) within their region. Within EFH, councils are required to minimize the adverse effects of fishing gear (such as harmful bottom trawls and dredges) on EFH only "to the extent practicable."[77] This has been a significant limiting factor in the prioritization of EFH protections. NRDC's assessment of implementation of this provision is that, with some exceptions, the EFH requirement has generally not reduced fishing's ongoing adverse impacts on fish habitat and marine ecosystems, and the requirement has been implemented unevenly across the regions.

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[72] *See* California Ocean Protection Council, *Readying California Fisheries for Climate Change*, at 31-34 (June 2017), https://www.oceansciencetrust.org/wp-content/uploads/2016/06/Climate-and-Fisheries_GuidanceDoc.pdf.
[73] *See, e.g.*, Howard Townsend et al., *Progress on Implementing Ecosystem-Based Fisheries Management in the United States Through the Use of Ecosystem Models and Analysis*, 6 Front. Mar. Sci. art. 641 (2019).
[74] *See, e.g.*, WRAP, *supra* note 70; National Marine Fisheries Service Policy No. 01-120 (May 23, 2016) (EBFM Policy).
[75] *See, e.g.*, Fiorenza Micheli et al., *Evidence That Marine Reserves Enhance Resilience to Climatic Impacts*, 7 PLoS ONE e40832 (2012); Steven Murawski et al., *Large-Scale Closed Areas as a Fisheries Management Tool in Temperate Marine Systems: The Georges Bank Experience*, 66 Bull. Mar. Sci. 775 (2000); Kevin Lafferty & Michael Behrens, *Temporal Variation in the State of Rocky Reefs: Does Fishing Increase the Vulnerability of Kelp Forests to Disturbance?*, *in* Proceedings of the Sixth California Islands Symposium, Ventura, California (2005), http://homes.msi.ucsb.edu/~lafferty/PDFs/Kelp_Forest/Lafferty_Behrens.pdf.
[76] Manuel Barange et al. (eds.), United Nations Food & Agriculture Organization, *Impacts of Climate Change on Fisheries and Aquaculture: Synthesis of Current Knowledge, Adaptation and Mitigation Options* (2018), *available at* http://www.fao.org/3/i9705en/i9705en.pdf.

[77] 16 U.S.C. § 1853(a)(7).

Councils need both stronger direction and better tools to effectively protect EFH from fishing impacts. One such action would be to provide additional agency guidance to constrain the malleability of the "practicability" standard, help councils to measure conservation benefits of EFH protections, and to make clear that economic feasibility alone should not be the basis of practicability analysis.[78]

More support is also needed for managers and scientists to address the question of how EFH can be used as a tool to enhance fishery health and resilience in the face of climate change. Managing fisheries in this context will require managers to look beyond historical data sets and consider dynamic oceanographic information, climate models, and other projections to inform many components of fisheries management, including EFH identification and protection.[79] Climate change should be a factor in EFH analysis, including identification of habitat areas of particular concern (HAPCs), for species known to be highly vulnerable to climate change or experiencing range shifts.[80]

NRDC also urges expanded efforts to significantly reduce impacts of non-fishing activities, such as dredging, sand mining, energy exploration, and coastal development more generally, on essential fish habitat. The inshore and estuarine habitats that are most stressed or degraded by pollution and development, such as seagrasses and mangroves, serve both as carbon sinks ("blue carbon") and as critical breeding, shelter, and feeding grounds for marine fish populations. EFH consultations are a critical tool that NOAA Fisheries already uses to assess and minimize the impacts of human activity on the marine environment.[81] We support revisions to the EFH consultation process that would allow NOAA Fisheries and the councils to more strongly require federal agencies to avoid adverse impacts on EFH from projects they fund, authorize, or undertake.

Lastly, we urge NOAA Fisheries and the councils to redouble efforts to protect forage fish, which fuel ocean food webs off every coast. Healthy forage fish populations help make ecosystems more resilient to the threats of climate change by supporting stable food webs for marine mammals, seabirds, sharks, and commercially and recreationally important fish species.[82]

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[78] Some fishery managers have already identified a need for more detailed guidance in the regulations for what constitutes a "practicable" habitat protection. *See, e.g.*, Terra Lederhouse et al., *Report from the National Essential Fish Habitat Summit*, NOAA Tech. Memo. NMFS-OHC-3, at 12 (Aug. 2017).

[79] *See, e.g.*, John Manderson, *Nowcasting Seascape Dynamics to Better Estimate Past & Future Species-Habitat Distributions*, NOAA Fisheries, presented at Fisheries Leadership and Sustainability Forum, National EFH Summit (2016), *available at* https://sites.nicholasinstitute.duke.edu/fisheries-forum/wp-content/uploads/sites/5/2019/02/Habitat-science_Manderson.pdf.

[80] 50 C.F.R. § 600.815(a)(8).

[81] 16 U.S.C. § 1855(b); 50 C.F.R. §§ 600.910-930.

[82] *See* Pikitch et al. (2012), *supra* note 33; A.J. Read & C.R. Brownstein, *Considering Other Consumers: Fisheries, Predators, and Atlantic Herring in the Gulf of Maine*, 7 Conserv. Ecol. art. 2 (2003); Lauren Scopel et al., *Varied Breeding Responses of Seabirds to a Regime Shift in Prey Base in the Gulf of Maine*, 626 Mar. Ecol. Prog. Ser. 177 (2019).

However, many of our iconic forage species in the U.S., including river herring and shad along the Atlantic coast, Pacific herring, and Pacific sardine, are at fractions of their historic abundance and subject to continued overfishing and/or excessive mortality.[83] Populations of forage fish are also highly influenced by changing ocean temperatures, including their characteristics of abundance, geographic distribution, reproductive success, and physical condition.[84]

Although NOAA Fisheries and the councils have the authority to proactively protect forage fish, significant management gaps remain, and not all regions have taken conservation action to account for these species' key role in the ecosystem. NRDC recommends the following actions be prioritized across all federally managed fisheries: setting science-based catch limits for managed forage species that account for their unique role in the ecosystem;[85] bringing currently unmanaged species that are subject to fishing effort (such as river herring and shad) into FMPs;[86] preventing directed fishing on unmanaged forage species;[87] and prioritizing highly depleted forage populations for protection under the Endangered Species Act.[88]

II. NOAA Must Improve Systems to Protect Marine Mammals From Climate Change.

A. Climate Change is Profoundly Impacting Marine Mammals.

Marine mammals have been described as "climate sentinels" due to their timely and measurable responses to ecosystem and climate variability.[89] These species are therefore extremely vulnerable to the impacts of climate change. Evidence suggests that marine mammals are already profoundly impacted by climate change in a myriad of ways and that these impacts will continue to intensify.[90] Potential extinction of the marine mammal species most vulnerable to climate change may lead to a disproportionate loss of functional diversity and may ultimately threaten marine ecosystem stability and provision of ecosystem services.[91]

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[83] *See, e.g.*, Tim R. Baumgartner et al., *Reconstruction of the History of Pacific Sardine and Northern Anchovy Populations over the Past Two Millennia from Sediments of the Santa Barbara Basin, California,* 33 Cal. Coop. Oceanic Fish. Investig. Reps. 24 (1992); Daniel J. Hasselman et al., *Genetic Stock Composition of Marine Bycatch Reveals Disproportional Impacts on Depleted River Herring Genetic Stocks*, 73 Can. J. Fish. Aquat. Sci. 951 (2016).
[84] *See, e.g.*, Martin Lindegren et al., *Climate, Fishing, and Fluctuations of Sardine and Anchovy in the California Current*, 110 Proc. Nat'l Acad. Sci. 13,672 (2013).
[85] *See, e.g.*, New England Fishery Management Council, *Amendment 8 to the Atlantic Herring Fishery Management Plan* (2019), *available at* https://www.nefmc.org/library/amendment-8-2.
[86] *See, e.g.*, Mid-Atlantic Fishery Management Council, *Staff White Paper: River Herring and Shad – Potential Management by the Mid-Atlantic Fishery Management Council* (2016).
[87] *See, e.g.*, PFMC EWG Report, *supra* note 34.
[88] 16 U.S.C. § 1531 *et seq.*
[89] Elliott L. Hazen et al., *Marine top predators as climate and ecosystem sentinels*, 17 Frontiers in Ecology & Environment 565 (2019).
[90] Camille Albouy, *Global vulnerability of marine mammals to global warming*, 10 Scientific Reports 1 (2020).
[91] *Id*.

Species with specialized diets, restricted ranges, or reliance on specific substrates or sites, are particularly vulnerable.[92] High-latitude, predominately ice-obligate, marine mammals are arguably experiencing the most acute and intractable effects of climate change in the form of extreme habitat loss and degradation.[93] Eleven marine mammal species are endemic to the Arctic (three cetaceans, seven pinnipeds, and the polar bear) and the capacity of these species to adapt to ecosystem alteration caused by rapid warming remains an open question; for some species, the level of adaptation necessary to avoid extinction may not be possible.[94]

Range shifts in marine mammals are an "inevitable and undeniable consequence of climate change" across geographies,[95] and may occur as a result of degradation or shifts in habitat, including areas where prey of sufficient quantity and quality can be reliably located.[96] Range shifts are already occurring in some species as marine mammals track the corresponding climate-induced range shifts of their preferred prey.[97] Shifts in prey distribution may lead to extended search times, reduced foraging opportunities, and reduction in prey quantity or quality, resulting in malnourishment, impaired reproduction, and other negative health effects.[98] In the long-term, these shifts may come at a significant ecological cost, particularly for species that experience a significant reduction in overlap with their preferred prey.[99]

Marine mammals already face an overwhelming number of direct human-caused threats, including fisheries bycatch, vessel strikes, noise pollution, oil and gas exploration and development, plastics and other pollutants, and habitat destruction and degradation, among others.[100] If marine mammal range shifts coincide with areas that have higher levels of human activity, climate change will exacerbate the risk of direct human threats, essentially placing species in "double jeopardy."[101] These circumstances are already impacting some of the United States' most iconic species, including the critically endangered North Atlantic right whale and

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92 *Id*.
93 *Id*.
94 Sue E. Moore & Randall R. Reeves, *Tracking arctic marine mammal resilience in an era of rapid ecosystem alteration*, 16 PLoS Biology e2006708 (2018).
95 Susan O. Grose et al., *Climate change will re-draw the map for marine megafauna and the people who depend on them*, 7 Frontiers in Marine Science, 547 (2020).
96 *Id*.
97 Gregory K. Silber et al., *Projecting marine mammal distribution in a changing climate*, 4 Frontiers in Marine Science, 413 (2017).
98 *Id*.
99 Dinara Sadykova et al., *Ecological costs of climate change on marine predator–prey population distributions by 2050*, 10 Ecology & Evolution 1069 (2020).
100 Isabel C. Avila, Kristin Kaschner & Carsten F. Dormann, *Current global risks to marine mammals: taking stock of the threats*, 221 Biological Conservation 44 (2018).
101 *Id*. *See, e.g.*, Jarrod A. Santora et al., *Habitat compression and ecosystem shifts as potential links between marine heatwave and record whale entanglements*, 11 Nature Communications 1 (2020); Marie Guilpin et al., *Repeated Vessel Interactions and Climate-or Fishery-Driven Changes in Prey Density Limit Energy Acquisition by Foraging Blue Whales*, 7 Frontiers in Marine Science 626 (2020); Nicholas R. Record et al., *Rapid Climate-Driven Circulation Changes Threaten Conservation of Endangered North Atlantic Right Whales*, 32 Oceanography 162 (2019).

the North Pacific gray whale.[102] In general, IUCN-recognized endangered or vulnerable species are more likely to be impacted by climate change than non-listed species under a business-as-usual climate scenario. Some species, such as the North Pacific right whale and North Pacific gray whale, remain extremely vulnerable to even under a strong climate mitigation scenario.[103]

Sea surface temperature anomalies and increased frequency and severity of seasonal weather events caused by climate change are also likely to intensify infectious disease outbreaks that may result in mass mortality events in marine mammals.[104] Ocean warming events have also been found to coincide with harmful algal blooms that are fatal to marine mammals and other marine life, as well as humans when consumed through seafood.[105] The massive, nearly simultaneous toxic diatom bloom observed along the west coast of North America in spring 2015 occurred in response to a warm water anomaly, known as the northeast Pacific marine heatwave, or commonly as the "Blob," that started in the Gulf of Alaska in 2013 and continued to spread in 2014 and 2015.[106] During the heatwave, primary productivity was unusually low and prey abundance was significantly reduced; the scarce prey that were available were contaminated with toxins. As a result, marine mammals and other marine predators experienced a mass mortality event due to starvation, poisoning, or both.[107] Climate model simulations combined with observations suggest that marine heatwaves in the North Pacific, and likely elsewhere, may intensify with climate change.[108] Infectious diseases and toxic blooms can also be expected to increase, undermining the overall health of marine mammals and their ecosystem.

B. NOAA Should Develop New Tools to Help Identify and Address Climate Impacts.

NOAA is mandated to protect marine mammals under the Marine Mammal Protection Act and the Endangered Species Act. The impacts described in Section II.A, which are by no means exhaustive, demonstrate that effectively protecting marine mammal species and populations from the impacts of climate change poses a complex challenge. The dynamic nature of observed and expected impacts, the interaction of multifarious individual and cumulative stressors, and ever-present uncertainties, must be accounted for. Ensuring the climate resiliency of marine mammal

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[102] NOAA Fisheries, *2017-2021 North Atlantic right whale Unusual Mortality Event*, available at https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event; NOAA Fisheries, 2019-2021 Gray whale Unusual Mortality Event along the West Coast and Alaska, available at https://www.fisheries.noaa.gov/national/marine-life-distress/2019-2021-gray-whale-unusual-mortality-event-along-west-coast-and.

[103] Albouy et al., *supra* note 90.

[104] Claire E. Sanderson & Kathleen A. Alexander, *Unchartered waters: Climate change likely to intensify infectious disease outbreaks causing mass mortality events in marine mammals*, 26 Global Change Biology 4284 (2020).

[105] Zhi Zhu et al., *Understanding the blob bloom: Warming increases toxicity and abundance of the harmful bloom diatom Pseudo-nitzschia in California coastal waters*, 67 Harmful Algae 36 (2017).

[106] Vera L. Trainer et al., *Pelagic harmful algal blooms and climate change: Lessons from nature's experiments with extremes*, 91 Harmful Algae 101591 (2020).

[107] *Id.*

[108] *Id.*

species and populations will therefore require NOAA to develop new tools and strengthen existing approaches. Below, we detail our specific recommendations on priority areas requiring the immediate attention of the agency.

1. Climate Impact Management Plans for Marine Mammals.

NOAA should develop "Climate Impact Management Plans" to guide the protection and management of marine mammal species and populations at highest risk of climate change and use its authority under the Marine Mammal Protection Act to implement those plans.[109] Each Climate Impact Management Plan should include a comprehensive strategy for mitigating the direct and indirect effects of climate change and increasing resiliency in the species or population, and should identify conservation and management measures to (1) mitigate, to the extent possible, the direct adverse effects of climate change on the species or population and its prey; (2) monitor, reduce, and prevent interactions with other human activities that may occur as a result of range shifts or other indirect effects of climate change; and (3) increase resiliency by materially reducing other human impacts on the species or population, such as a reduction in incidental take and degradation of habitat, and by managing prey species to improve the availability and quality of prey (*see also*, Section I.E., discussing EBFM).

In the first instance, we recommend the agency develop and implement Climate Impact Management Plans for the following three priority species and populations: Eastern North Pacific gray whale (*Eschrichtius robustus*), Southern Resident killer whale (*Orcinus orca*), and North Atlantic right whale (*Eubalaena glacialis*). We also note that the North Pacific right whale (*Eubalaena japonicus*) and narwhal (*Monodon monoceros*) were recently identified as two of the most sensitive species to climate change globally,[110] and we encourage NOAA to undertake the necessary baseline research to better understand the management needs of these species in U.S. waters.

In addition to developing the Climate Impact Management Plans for the species and populations described below, NOAA should compile a list of other marine mammal species and populations for which climate change, alone or in combination or interaction with other factors, has more than a remote possibility of resulting in a decline in population abundance, or impeding population recovery, or reducing carrying capacity. This list should be used as the basis for developing and implementing future Climate Impact Management Plans for other species and populations. The list should be reviewed, in consultation with the Marine Mammal Commission, every five years, or more frequently if significant new information becomes available. Considering the uncertainties associated with climate change, and the still incomplete knowledge

[109] *See e.g.,* 16 U.S.C. § 1382.
[110] Albouy et al., *supra* note 90.

regarding many marine mammal species and populations, a lack of available quantitative information on climate impacts should not be viewed by the agency as lack of potential impacts.

a. Eastern North Pacific gray whale.

Eastern North Pacific gray whales are presently experiencing a major die-off that was declared by NOAA as an Unusual Mortality Event (UME) in 2019.[111] As of March 2021, the total number of documented mortalities across the population's range was 418 animals[112] and NOAA has estimated that the population has declined by approximately 24 percent since 2016.[113] Necropsy results indicate many of the whales were emaciated. More than 50 percent of the gray whales observed in their calving lagoons, in Baja California, in 2019 showed signs of "skinniness."[114] Starvation has been identified as a likely contributing factor to the UME, and may have also reduced the reproductive rate of the population.[115]

The underlying factors that caused the gray whale's reduction in body condition have yet to be determined; however, gray whales were found to be already exhibiting poor body condition upon arrival at their calving grounds, suggesting the underlying cause began either on the feeding grounds or during the southbound migration.[116] Gray whales feed opportunistically in several locations along their migratory route and annual variations in the relative prey productivity of different foraging habitats, or a decline in their prey on their feeding grounds, could influence their body condition.[117] The energetic costs of an individual whale's migration may also be increased by interaction with human activities (*e.g.*, alteration of optimal migration route, increased swim speed, stress). Other factors, such as disease, may also be at play.[118]

NOAA should develop and implement a Climate Impact Management Plan for the Eastern North Pacific gray whale that aims to determine if and how climate change is presently impacting this population and/ or may affect the population the future. NOAA should specifically consider the effect of climate change on gray whale prey distribution, availability, and quality, and the risk of disease (*e.g.*, resulting from harmful algal blooms), and how climate factors may cumulatively

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[111] NOAA, *2019-2021 gray whale Unusual Mortality Event along the West Coast and Alaska*, available at https://www.fisheries.noaa.gov/national/marine-life-distress/2019-2021-gray-whale-unusual-mortality-event-along-west-coast-and.
[112] *Id*.
[113] Joshua D. Stewart & David W. Weller, *Abundance of eastern North Pacific gray whales 2019/2020*, NOAA Technical Memorandum NMFS-SWFSC-639 (2021).
[114] NMFS, Frequent questions: 2019 gray whale Unusual Mortality Event along the west coast, available at https://www.fisheries.noaa.gov/national/marine-life-distress/frequent-question-2019-gray-whale-unusual-mortality-event-along-west (accessed March 31, 2021).
[115] Fredrik Christiansen et al., *Poor body condition associated with an unusual mortality event in gray whales*, 658 Mar. Ecology Progress Series 237 (2021).
[116] *Id*.
[117] *Id*.
[118] *Id*.

interact with other direct stressors, including vessel collisions, entanglement in fishing gear, and exposure to noise pollution.

b. Southern Resident killer whale.

The Southern Resident killer whale population of the Pacific Northwest is one of the most critically imperiled, iconic populations of marine mammals on the planet. The total abundance for the Southern Resident killer whale population was revised in September 2020 and now stands at only 74 whales.[119] Southern Residents are highly reliant on threatened Chinook salmon as their primary food source[120] and Chinook size and abundance are closely related to the survival and reproductive success of the species.[121] Chinook salmon are declining, however, and Southern Resident killer whales are seriously malnourished and experiencing elevated levels of reproductive failure.[122] Chinook salmon, in turn, are highly threatened by the extreme modification of their historic spawning grounds and migration routes resulting from the installation of a system of hydropower dams in the Columbia Basin, as well as general mismanagement of the species by federal and state agencies.[123] These stressors are now compounded by climate change.[124]

In 2015, the Pacific marine heat wave, low river flows, and record high water temperatures were observed in the Columbia River Basin.[125] Worryingly, these extreme weather conditions, which contributed to a near-complete failure of the adult migration of endangered Snake River sockeye salmon, are characteristic of projected future conditions. Modelling of migration timing and survival under historic and future climate scenarios (2040s) indicate reduction in adult survival of Chinook salmon by up to 15 percent (survival of sockeye salmon dropped by approximately 80 percent of their already low levels).[126] The reduced survival rates resulting from a changing climate are only exacerbated by the eight major hydro-system dams that profoundly affect temperatures and flows experienced by salmon in the Columbia Basin, as well as other

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[119] *See* Marine Mammal Commission, *Southern Resident Killer Whale*, available at https://www.mmc.gov/priority-topics/species-of-concern/southern-resident-killer-whale/#:~:text=The%20total%20abundance%20for%20the,stands%20at%20only%2074%20whales.

[120] Michael J. Ford et al., *Estimation of killer whale (Orcinus orca) population's diet using sequencing analysis of DNA from feces*, 11 PLoS ONE e0144956 (2016); M. Bradley Hanson et al., *Endangered predators and endangered prey: Seasonal diet of Southern Resident killer whales*, 16 PloS ONE e0247031 (2021).

[121] Samuel K. Wasser et al., *Population growth is limited by nutritional impacts on pregnancy success in endangered Southern Resident killer whales (Orcinus orca)*, 12 PLoS ONE e0179824 (2017).

[122] *Id*.; Hanson, M.B et al., *supra* note 120; Holly Fearnbach, *Using aerial photogrammetry to detect changes in body condition of endangered southern resident killer whales*, 35 Endangered Species Research 175 (2018).

[123] Lisa G. Crozier et al., *Snake River sockeye and Chinook salmon in a changing climate: Implications for upstream migration survival during recent extreme and future climates*, 15 PloS ONE e0238886 (2020).

[124] Lisa G. Crozier, *Climate change threatens Chinook salmon throughout their life cycle*, 4 Communications Biology 1 (2021).

[125] *Id*.

[126] *Id*.

inappropriate management measures (e.g., transportation of juvenile salmon by truck or barge).[127]

NOAA should develop and implement a Climate Impact Management Plan for Southern Resident killer whales that includes the restoration of key habitats, including access to historic spawning grounds, that is necessary for the survival of Chinook salmon and, in turn, the Southern Resident killer whale. Such action requires significant federal and state inter-agency collaboration. The survival of Southern Resident killer whales will require meaningful collaboration between different departments within NOAA (*i.e*., the Office of Protected Resources and NOAA Fisheries) and different management agencies with purview over the land and sea (*i.e.*, Pacific Fishery Management Council, Army Corps of Engineers, etc.).

As a general matter, NOAA should explicitly identify species and stocks for which a land-sea ecological connection is vital for their survival and/ or recovery. For those species, NOAA should develop a plan to initiate or, if already initiated, bolster intra-agency and inter-agency collaboration, with the specific goal of developing cross-cutting solutions to address climate change impacts both on land and at sea.

c. North Atlantic right whale.

Climate-driven changes in oceanographic conditions, and resulting shifts in prey distribution, are rapidly changing the spatial and temporal patterns of habitat use by North Atlantic right whales.[128] This range shift has placed the species at increased risk of vessel collision and entanglement in fishing gear in the United States and Canada. In 2019, North Atlantic right whales were listed as a NOAA "Species in the Spotlight" indicating that they are one of nine marine species to be at greatest risk of extinction in the United States.[129] In July 2020, the International Union for Conservation of Nature ("IUCN") reclassified the North Atlantic right whale from "endangered" to "critically endangered" on the IUCN Red List of Threatened Species, one step away from "extinction."[130]

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[127] *Id*.

[128] *See, e.g.*, Genevieve E. Davis et al., *Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (Eubalaena glacialis) from 2004 to 2014*, 7 Scientific Reports, 13460 (2017); Genevieve E. Davis et al., *Exploring movement patterns and changing distributions of baleen whales in the western North Atlantic using a decade of passive acoustic data*, 26 Global Change Biology 4812 (2020); Record et al., *supra* note 101.

[129] NOAA Fisheries, *North Atlantic right whale – In the Spotlight*, available at https://www.fisheries.noaa.gov/species/north-atlantic-right-whale#spotlight.

[130] J.G. Cooke, *Eubalaena glacialis*, The IUCN Red List of Threatened Species, e.T41712A162001243 (2020),available at https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T41712A162001243.en.

Elevated deaths from vessel collisions and entanglements led NOAA to declare a UME for the species in 2017.[131] However, the species has been in decline since 2010[132]—a date corresponding with the timing of the range shifts caused by climate change.[133] The rate of decline is worsening. The best population estimate for the end of 2019 is just 356 individuals indicating that approximately ten percent of the species has been lost in the last three years.[134] The decline of the species over the past decade is also deeply disturbing. According to NOAA Fisheries' Draft Biological Opinion,[135] an unnerving 201 North Atlantic right whales were killed from 2010 to 2019.[136] This number is an underestimate, as documented serious injuries and deaths only represent a small fraction of whales that are injured or killed by human activities.[137] A recently published scientific study concludes only 29 percent (2 standard error = 2.8 percent) of North Atlantic right whale carcasses were detected from 2010 to 2017.[138]

Further, females are more negatively affected than males by the lethal and sublethal effects of human activity, now surviving to only 30-40 years of age with an extended inter-calf interval of approximately ten years.[139] Calf survival is also severely diminished. Three calves born during the last two calving seasons are already either confirmed or likely dead due to vessel strikes.[140] One of the calves' mothers has been declared seriously injured due to the strike that killed her

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[131] NOAA, *2017-2021 North Atlantic right whale Unusual Mortality Event*, available at https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event.

[132] Richard M. Pace et al., *State-space mark-recapture estimates reveal a recent decline in abundance of North Atlantic right* whales, 21 Ecology and Evolution 8730 (2017).

[133] Record et al., *supra* note 101; Davis et al. *supra* note 128.

[134] H.M. Pettis et al., *North Atlantic Right Whale Consortium 2020 Annual Report Card*, Report to the North Atlantic Right Whale Consortium (2020), available at https://www.narwc.org/uploads/1/1/6/6/116623219/2020narwcreport_cardfinal.pdf. The estimate reflects the best population estimate for the start of 2019 (366 individuals) minus the recorded whale deaths that occurred in 2019 (10).

[135] NMFS, *Draft Endangered Species Act Section 7 Consultation on the: (a) Authorization of the American Lobster, Atlantic Bluefish, Atlantic Deep-Sea Red Crab, Mackerel/Squid/Butterfish, Monkfish, Northeast Multispecies, Northeast Skate Complex, Spiny Dogfish, Summer Flounder/Scup/Black Sea Bass, and Jonah Crab Fisheries and (b) Implementation of the New England Fisheries Management Council's Omnibus Essential Fish Habitat Amendment 2*, Consultation No. GARFO-2017-00031.

[136] *Id*. at 225.

[137] Sarah .M. Sharp et al., *Gross and histopathologic diagnoses from North Atlantic right whale Eubalaena glacialis, mortalities between 2003 and 2018*, 135 Diseases of Aquatic Organisms 1 (2019); Richard M. Pace III et al., *Cryptic mortality of North Atlantic right whales*, 3 Conservation Science & Practice e346 (2021).

[138] Pace et al., *id*.

[139] Peter Corkeron et al., *The recovery of North Atlantic right whales, Eubalaena glacialis, has been constrained by human-caused mortality*, 5 Royal Society Open Science 180892 (2018).

[140] NMFS, *2017-2021 North Atlantic right whale Unusual Mortality Event*, available at https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event.

calf, one mother has not been resighted, and the third has been seriously injured from entanglement in fishing gear.[141] A fourth calf was found to have died of natural causes.[142]

NOAA should develop and implement a Climate Impact Management Plan for North Atlantic right whales that addresses how vessel collision and entanglement can be immediately and significantly reduced, how threats resulting from further range shifts can be predicted and pre-emptively mitigated, and how all other human-caused stressors, such as noise pollution, can be reduced to enhance the resiliency of North Atlantic right whales to future environmental change.

2. Monitoring of Climate Impacts on Marine Mammals.

NOAA should undertake targeted monitoring activities to improve understanding of the impacts of climate change on marine mammal species and populations. To fulfil this goal, NOAA should establish a dedicated monitoring program and, for strategic stocks, incorporate this work as part of the agency's preparation of marine mammal Stock Assessment Reports.[143] The purposes of the monitoring program should, at minimum, be to: (1) improve models of projected future changes in marine mammal distribution and densities resulting from climate change; (2) identify and monitor interactions with other human activities that may occur as a result of changes in marine mammal distribution or other effects of climate change; and (3) monitor the abundance of species and populations to an extent sufficient to detect a decline caused by climate change or other human activities. The data and findings generated by the monitoring program should be used to inform the development of Climate Change Mitigation Plans and the development of the list of marine mammal species and populations that may be particularly vulnerable to climate impacts (*see* Section II.B.1).

3. Incorporate Climate Change Impacts in the Estimation of Potential Biological Removal.

In accordance with Section 117 of the MMPA, NOAA publishes annual Stock Assessment Reports that include the potential biological removal (or "PBR") level for marine mammal stocks. PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach

[141] *Id.*

[142] *Id.*

[143] 16 U.S.C. 1386 § 117(a)(3). "Each draft stock assessment, based on the best scientific information available, shall" . . . "estimate the annual human-caused mortality and serious injury of the stock by source and, for a strategic stock, *other factors that may be causing a decline or impeding recovery of the stock, including effects on marine mammal habitat and prey*" (emphasis added).

or maintain its optimum sustainable population.[144] The PBR level is a product of the minimum population estimate of the stock, one half the maximum theoretical or estimated net productivity rate of the stock at a small population size, and a recovery factor between 0.1 and 1.0.[145] NOAA, in preparing its stock assessments, should take into account the adverse impacts of climate change in determining the recovery factor applied to each stock.

4. NOAA Should Develop a Near Real-Time Monitoring System for Large Whales

Dynamic range shifts caused by climate change are placing several large whale species and populations in increased jeopardy of direct human impacts.[146] In some cases, such as the North Atlantic right whale, the exacerbation of these direct stressors is driving species to extinction. There is an urgent need for NOAA to detect the occurrence and distribution of large whales and use that information to directly trigger mitigation procedures in near real-time, in order to curtail the risk to large whales from vessel collisions, entanglement in commercial fishing gear, and to minimize other impacts, including but not limited to, underwater noise from development activities.

We recommend that NOAA design and deploy a "Near Real-Time Large Whale Monitoring and Mitigation Program" capable of detecting and alerting ocean users and enforcement agencies of the location of large whales on a near real-time basis, informing the sector-specific mitigation protocols than can effectively reduce take of large whales, and continually integrate improved technology. NOAA should first establish a pilot monitoring and mitigation project for North Atlantic right whales for the purposes of informing a cost-effective, efficient, and results-oriented near real-time monitoring and mitigation program for large whales. In designing and deploying the monitoring system, NOAA should, using best available science, identify and ensure coverage of important feeding, breeding, calving, rearing, or migratory habitats of North Atlantic right whales that co-occur with areas of high risk from vessel strikes, disturbance from development activities, and entanglement in commercial fishing gear.

The pilot program should include near real-time monitoring methods, technologies, and protocols that: (1) comprise sufficient detection power, spatial coverage, and survey effort to detect and localize North Atlantic right whales within core foraging habitats; (2) are capable of detecting North Atlantic right whales visually, including during periods of poor visibility and darkness, and acoustically; (3) take advantage of dynamic habitat suitability models that help to

[144] 16 U.S.C. § 1362(20). An "optimum sustainable population" is defined by the MMPA section 3(9), with respect to any population stock, as the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element. 16 U.S.C. § 1362(3)(9).
[145] *Id.*
[146] *See, e.g.*, citations at footnotes 100-101.

discern the likelihood of North Atlantic right whale occurrence in core foraging habitat at any given time; (4) coordinate with the Integrated Ocean Observing System to leverage monitoring assets; (5) integrate new near real-time monitoring methods and technologies as they become available; (6) accurately verify and rapidly communicate detection data; and (7) allow for ocean users to contribute data that is verified to be collected using comparable near real-time monitoring methods and technologies. NOAA should provide access to data generated by the monitoring system for purposes of scientific research and evaluation, and public awareness and education, through public web portals.

In parallel, NOAA, in consultation with relevant agencies and affected stakeholders, should develop and deploy mitigation protocols that make use of the near real-time monitoring system to direct sector-specific mitigation measures that avoid and significantly reduce risk of disturbance, injury and mortality to North Atlantic right whales.

NOAA should subsequently develop a strategic plan to expand the pilot program to provide near real-time monitoring and mitigation measures to all large whale species under U.S. jurisdiction within three years of the deployment of the pilot program.

C. NOAA Should Develop New Regulations and Increase International Cooperation to Protect Extremely Vulnerable Arctic Species from Ocean Noise Pollution

The Arctic is a unique acoustic environment and maintaining its acoustic integrity should be a primary goal of NOAA. Ambient sound levels in the Arctic are some of the lowest on Earth and Arctic marine species have had limited exposure to ocean noise pollution caused by human activities.[147] This naivete means Arctic marine mammals, and their prey, will likely be disproportionately impacted by any increase in ocean noise.[148] Many Arctic marine mammals are in serious jeopardy from additional seemingly intractable climate change impacts, including the diminishment of sea ice habitat,[149] and impacts from noise will further undermine the possibility of their survival.

The strong international interest in developing an increasingly ice-free Arctic means that Arctic marine mammals may face significant and rapid increases in ocean noise pollution.[150] For example, noise from shipping increased substantially in multiple locations across the Arctic between 2013 and 2019, and some areas of the Arctic are now twice as loud as they were in

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[147] PAME, *Underwater noise in the Arctic: A state of knowledge report*, Roveniemi (May 2019), Protection of the Arctic Marine Environment (PAME) Secretariat, Akureyri.
[148] *Id*.
[149] Moore & Reeves, *supra* note 94.
[150] William D. Halliday, Matthew K. Pine and Stephen J. Insley, *Underwater noise and Arctic marine mammals: review and policy recommendations*, 28 Environmental Reviews 438 (2020).

2013.[151] Climate change is also changing the Arctic acoustic environment in other ways. Sound travels faster as water temperatures rise. Loss of sea ice reduces propagation loss and increases ambient sound levels due to increased interaction between the surface and the atmosphere. The Arctic is also becoming stormier during the ice-free season and increased wind speeds may lead to greater ambient sound levels.[152]

Despite these imminent concerns, none of the six countries with an Arctic coastline have policies on underwater noise specific to the Arctic.[153] The U.S. is well positioned to take a leadership role on this issue.

In 2016, NOAA published the *Ocean Noise Strategy Roadmap,* designed to support the implementation of an agency-wide strategy for addressing ocean noise pollution over the subsequent ten years.[154] NOAA is now five years into the implementation of the *Roadmap* and, while some progress has been made, work was stymied during the previous administration. NOAA should re-evaluate and commit new resources and capacity to implement and evolve the *Roadmap,* with a special focus on soundscape management in the Arctic.

As part of this work, NOAA should develop new regulations to limit noise produced by current and future U.S. activities in the Arctic. Regulatory options include the development of "Acoustic Technical Guidance" specific to assessing the effects of anthropogenic noise on marine mammals in the Arctic. The guidance must be based on best available scientific information on the onset of permanent and temporary threshold shifts, and behavioral responses of Arctic marine mammals to noise.[155] NOAA should also include noise pollution as an indicator in the annual "Arctic Report Card."[156]

NOAA, through the U.S. delegation to the Arctic Council, should work with other Arctic Council members to develop a shared approach to ocean noise minimization in the Arctic. The Protection of the Arctic Marine Environment (PAME) Working Group of the Arctic Council is leading a process to better understand the impacts of ship noise in the Arctic and how to mitigate

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[151] PAME, *Underwater noise pollution from shipping in the Arctic report*, Submitted by the Protection of the Arctic Marine Environment Working Group of the Arctic Council to the Chairman of the SAOs and the Arctic Council SAOs, Reykjavik, Iceland (Feb. 18, 2021).
[152] Halliday et al. *supra* note 150.
[153] *Id*.
[154] NOAA, *Ocean Noise Strategy Roadmap*, available at https://cetsound.noaa.gov/Assets/cetsound/documents/Roadmap/ONS_Roadmap_Final_Complete.pdf.
[155] NOAA should also update its current Acoustic Technical Guidance to reflect best available science. The current guidance for Level B harassment in particular is woefully outdated. *See, e.g.*, Catalina Gomez et al., *A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy*, 94 Canadian Journal of Zoology 801 (2016).
[156] *See* NOAA Arctic Program, Arctic Report Card: Update for 2020, available at https://www.arctic.noaa.gov/Portals/7/ArcticReportCard/Documents/ArcticReportCard_full_report2020.pdf.

those impacts.[157] We encourage NOAA, through the U.S. delegation to the Arctic Council, to support these efforts and proactively explore additional avenues to protect the Arctic from noise pollution from shipping and other industrial and military activities. One suitable policy may entail postponing noise-producing activities in the Arctic until safe noise limits for shipping and other industrial and military activities have been formulated for the Arctic. In that vein, NOAA should cooperate internationally with other states and agencies, as appropriate, to determine noise limits sufficiently protective of Arctic marine mammals and the wider ecosystem.

Separately, to ensure coherent international standards for the region, NOAA, through the U.S. delegation to the Arctic Council, should support extending the International Code for Ships Operating in Polar Waters ("Polar Code") adopted by the International Maritime Organization[158] to address noise pollution.

D. NOAA Has a Duty to Recognize and Respect Tribes' Sovereign Status and Collaborate Directly with Tribal Governments in a Consultative Process.

Marine mammals are of immense cultural and spiritual significance to certain tribes, and Native American and Alaska Native Tribes are sovereign governments recognized as self-governing under federal law, and the U.S. government has a "trust responsibility" to those Tribes. [159] The federal government has special fiduciary obligations to protect Native resources and uphold the rights of indigenous peoples to govern themselves on tribal lands.[160] In carrying out this duty, federal officials are "bound by every moral and equitable consideration to discharge the federal government's trust with good faith and fairness."[161] The trust doctrine includes duties to manage natural resources for the benefit of Tribes and individual landowners, and the federal government has in some cases been held liable for mismanagement.[162]

Further, the unique legal status of Native American and Alaska Native Tribes creates an important requirement for governmental entities, and other stakeholders, to understand that the federal government must consult directly with Tribal governments when contemplating actions

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[157] See, e.g., PAME *supra* note 151.
[158] *Available at* https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/POLAR%20CODE%20TEXT%20AS%20ADOPTED.pdf.
[159] *Worcester v. Georgia*, 31 U.S. 515 (1832).
[160] *Eric v. Sec'y of U. S. Dep't of Hous. & Urban Dev.*, 464 F. Supp. 44 (D. Alaska 1978).
[161] *United States v. Payne*, 264 U.S. 446, 448 (1924); *accord Yukon Flats School Dist. V. Native Village of Venetie* Tribal Govt't, 101 F.3d 1286 (9th Cir. 1996) *rev'd on other grounds* 522 U.S. 520 (1998); *see also* 84 Fed. Reg. 1200–01 (Feb.1, 2019) (including 229 Alaska Native entities in the list of tribes recognized as having the immunities and privileges of "acknowledge Indian tribes by virtue of their government-to-government relationship with the United States").
[162] *See United States v. Mitchell*, 463 U.S. 206 (1983) (holding that the Department of the Interior was liable for monetary damages for mismanaging timber resources of the Quinault tribe in violation of the agency's fiduciary duty).

that may affect tribal lands, resources, members, and welfare.[163] Executive Order 13175 mandates that all executive agencies recognize and respect Tribe's sovereign status.[164] The order also requires agencies to establish policies and procedures to ensure meaningful and timely consultation with Tribes when an actions affects tribal interests.[165] Tribal sovereignty is thwarted when federal government agencies and departments attempt to treat Tribes in the same manner as any other interested members of the public, in a conventional public participation process.[166] Rather, in recognition of their status as sovereign nations, the federal government should collaborate directly with Tribal governments in a consultative process, which leads to informed decision-making.

III. NOAA Must Improve Use of Existing Authorities to Protect Sharks.

A. Climate Change Will Affect the Health of Elasmobranchs—a Species Group Already at Risk.

Sharks and shark-like fish (hereafter, "sharks") face tremendous threats. Roughly 25 percent of sharks, rays, and chimaeras are at risk of extinction, with nearly 200 species classified as critically endangered, endangered, or vulnerable by the International Union for the Conservation of Nature (IUCN).[167] Over 75 percent of oceanic sharks and rays are at risk of extinction, with half of oceanic shark species classified as critically endangered and or endangered.[168] As top-level predators, sharks play an important role in marine ecosystem, both as top-level predators influencing food chains and also connecting distant ecosystems through their long migrations.[169] Loss of sharks may cause disruption of marine food webs[170] and may exacerbate other climate-induced effects on marine ecosystems.[171] Recent studies indicate that climate change will likely have impacts on various shark species, including: decreasing suitable habitat for certain

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[163] Exec. Order No. 13,175, 65 Fed. Reg. 67,249, 67,249–50 (Nov. 6, 2000) (mandating that agencies "respect Indian tribal self-government and sovereignty" when "formulating and implementing policies" that affect tribal interests).
[164] *Id*.
[165] *Id*.
[166] Letter from George Alexi, President, Nondalton Tribal Council, to Lieutenant General Todd T. Semonite, Commanding General and Chief of Engineers, U.S. Army Corps of Engineers, at 2–3 (Sept. 27, 2019).
[167] Nickolas K. Dulvy et al., *Extinction risk and conservation of the world's sharks and rays*, eLife, 3: e00590 (2014).
[168] Nathan Pacoureau et al., *Half a century of global decline in oceanic sharks and rays*, Nature, 589, 567-571 (2021).
[169] Charlotte A. Birkmanis et al., *Future Distribution of Suitable Habitat for Pelagic Sharks in Australia Under Climate Change Models*, Front. Mar. Sci. Front. Mar. Sci. 7:570 (2020).
[170] Francesco Ferretti et al., *Loss of Large Predatory Sharks from the Mediterranean Sea*, 22(4) Con. Bio. 952-64 (2008).
[171] Robert J. Nowicki et al., *Loss of predation risk from apex predators can exacerbate marine tropicalization caused by extreme climatic events*. J. Anim. Ecol. 1-12 (2019).

species,[172] increasing shark populations in coastal ranges,[173] shifting species' ranges,[174] and potentially affecting the resilience of individual shark species.[175]

B. The U.S. Must Leverage Existing Laws and International Tools to Protect Sharks and Ensure their Resilience to Climate Impacts.

Importantly, the U.S. can have a direct impact on improving management and conservation of sharks and, in so doing, increasing the resilience of shark populations to respond to climate stressors. Many of the shark species considered at greatest risk of extinction either inhabit the exclusive economic zone (EEZ) of the U.S., are fished by U.S. vessels beyond the U.S. EEZ, or are subject to conservation and management measures of regional fisheries management organizations (RFMOs) to which the U.S. is a party. Moreover, a 2020 study found that a majority of shark-fishing effort is concentrated within EEZs, especially within the EEZs of the U.S. and five other nations,[176] which suggests that the U.S. may need to play an outsized role in leading global efforts to manage shark fishing and protect vulnerable populations around the world. For all of these reasons, the U.S. can and should play a meaningful role in leading shark conservation policies that can protect sharks and help these vulnerable predators be more resilient to climate change.

To meet this goal, NOAA Fisheries can and should implement the following approaches to help increase the resilience of shark populations to climate change.

C. NOAA Fisheries Must Use the MSA and the ESA to Secure the Health of Shark Populations.

NOAA Fisheries should ensure strong implementation of our domestic fisheries policies with respect to sharks. The U.S. has some of the strongest fisheries management regulations in the world, but these policies have consistently failed sharks. For example, NOAA Fisheries' failure to set a hard limit on bycatch of dusky sharks has led to continued overfishing of this vulnerable species.[177] Similarly, NOAA Fisheries initially failed to declare the highly endangered oceanic

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[172] Birkmanis et al., *supra* note 169, at 1 ; Elliot L. Hazen et al., *Predicted habitat shifts of Pacific top predators in a changing climate.* Nat. Clim. Chang. 3, 234–238 (2013); Brian D. Grieve et al., *Modeling the impacts of climate change on thorny skate (*Amblyraja radiata*) on the Northeast US shelf using trawl and longline surveys.* Fish. Oceanogr. 00:1-15 (2020).
[173] Shannon M. O'Brien et al., *Effects of species biology on the historical demography of sharks and their implications for likely consequences of contemporary climate change*, Conserv. Genet. 14, 125-144 (2013).
[174] O'Brien et al., *supra* note 173, at 141.
[175] Carolyn R. Wheeler et al., *Future thermal regimes for epaulette sharks (*Hemiscyllium ocellatum*): growth and metabolic performance cease to be optimal*, Sci. Rep. 11, 454 (2021).
[176] Kyle S. Van Houtan et al., *Coastal sharks supply the global shark fin trade.* Biol. Lett. 16: 20200609 (2020).
[177] Earthjustice, *Oceana Wins Lawsuit to Protect Overfished Dusky Sharks*, Press Release (Mar. 14, 2019); https://earthjustice.org/news/press/2019/oceana-wins-lawsuit-to-protect-overfished-dusky-sharks.

whitetip overfished, even after listing the species under the ESA.[178] NOAA Fisheries must recognize the intense pressures that sharks face, as well as their extreme vulnerability to overfishing – sharks are slow to reach sexual maturity, reproduce at a slow rate, and typically bear few young. Anticipating that climate impacts will put yet more stress on these already vulnerable predators, NOAA Fisheries must use the MSA to manage sharks precautionarily and ensure that fisheries management policies do not further erode the viability of these ancient species.

In some cases, the U.S. can also help shore up the resilience of sharks and rays by extending protections to their populations under the ESA. For example, NOAA Fisheries should expand the current ESA listing for scalloped hammerhead to include distinct population segments (DPS) of this species that are currently unprotected—i.e., the Central Pacific DPS and the Northwest Atlantic and Gulf of Mexico DPS—and to uplist the two threatened DPSs (i.e., the Central and Southwest Atlantic DPS and the Indo-west Pacific DPS) to endangered. The critically endangered oceanic whitetip is the first and only shark species for which retention is prohibited in all four major tuna RFMOs, and IUCN advises that *all* retention and landings of the species be prohibited as long as the global population is classified as critically endangered.[179] The oceanic whitetip is currently listed as threatened under the ESA, but a threatened listing does not prohibit take. The same is true for the ESA-listed manta ray species. NOAA Fisheries should immediately implement a ESA Section 4d rule for these species and also evaluate the oceanic whitetip for uplisting to endangered. NOAA Fisheries should also evaluate other species considered at greatest risk of extinction by IUCN for potential listing under ESA, including both pelagic sharks and rays that are commonly caught and traded in commercial fisheries for tuna and tuna-like fish, as well as species that are present within the U.S. EEZ and are thus highly affected by the fishing activities of U.S. fleets and fishermen.

D. NOAA Fisheries Must Use U.S. Law and Diplomacy to Lead Foreign Nations to End Illegal and Overfishing of Sharks

1. NOAA Fisheries must implement the High Seas Driftnet Fishing Moratorium Protection Act robustly in order to alleviate the acute pressures of illegal, unregulated and unreported fishing on global shark populations.

Some of the shark species most aggressively targeted by commercial fishing at a global scale are also those species at greatest risk of extinction—species such as the oceanic whitetip, scalloped hammerhead, and great hammerhead (all designated as critically endangered by IUCN), and the

[178] Earthjustice, *An Overfished Shark Species Will Now Finally Get The Protection It Needs In The Pacific*, Press Release (Jun. 29, 2020); https://earthjustice.org/news/press/2020/an-imperiled-pacific-shark-species-could-now-get-more-protection.

[179] Cassandra L. Rigby et al., *Carcharhinus longimanus.* The IUCN Red List of Threatened Species (2019); https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39374A2911619.en

dusky shark, pelagic thresher shark, longfin mako, and shortfin mako (all designated as endangered by IUCN).[180] Other species, such as the silky shark,[181] bigeye thresher,[182] and common thresher shark,[183] are classified as vulnerable to extinction, with populations decreasing. The giant manta ray[184] and several species of devil *(Mobula*) rays[185] are classified as endangered, with populations decreasing. These species are also often targeted through illegal, unregulated and unreported (IUU) fishing operations, for their meat, fins or gill plates. In fact, many of these species are among those most commonly found in the global shark fin trade.[186]

The U.S. can play a significant role in alleviating the IUU fishing pressure on these vulnerable species by leveraging U.S. law to push foreign nations to eradicate IUU shark fishing from their fleets. Under the High Seas Driftnet Fishing Moratorium Protection Act (HSDFMPA), NOAA Fisheries is directed to identify, consult with, and, where necessary, impose sanctions on nations whose vessel(s) are engaged in IUU fishing, or whose vessels bycatch protected species or fish for sharks on the high seas and lack a regulatory program comparable to that of the U.S. The HSDFMPA combines the strength of the U.S. legal framework with the power of our seafood import market (the world's largest) to compel other nations to halt IUU shark fishing within their fleets—a boon to the very oceanic shark and ray species whose populations are plummeting. But NOAA Fisheries chronically fails to leverage the power of the HSDFMPA to drive compliance with international agreements. Moreover, despite the fact that finning and targeting of sharks is known to occur on the high seas, NOAA Fisheries has rarely identified nations under the HSDFMPA for any shark violations, and never for fishing for sharks on the high seas. NOAA Fisheries must implement the HSDFMPA more robustly, in keeping with its statutory mandate, to push foreign nations to end illegal and targeted shark fishing in the world's oceans in order to give these species a chance to withstand the added pressures that will come with changing ocean conditions.

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[180] Pacoureau et al., *supra* note 168, at 568.
[181] Cassandra L. Rigby et al., *Carcharhinus falciformis*. The IUCN Red List of Threatened Species (2017); https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T39370A117721799.en.
[182] Cassandra L. Rigby et al., *Alopias superciliosus*. The IUCN Red List of Threatened Species (2019); https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T161696A894216.en.
[183] Cassandra L. Rigby et al., *Alopias vulpinus*. The IUCN Red List of Threatened Species (2019); https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39339A2900765.en.
[184] Andrea Marshall et al., *Mobula birostris.* The IUCN Red List of Threatened Species (2020); https://dx.doi.org/10.2305/IUCN.UK.2020- 3.RLTS.T198921A68632946.en.
[185] Andrea Marshall et al., *Mobula mobular* (amended version of 2019 assessment). The IUCN Red List of Threatened Species (2020); https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T110847130A176550858.en; Andrea Marshall et al., *Mobula hypostoma*. The IUCN Red List of Threatened Species (2019); https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T126710128A896599.en; Cassandra L. Rigby et al., *Mobula eregoodoo*. The IUCN Red List of Threatened Species (2020), https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T41832A166793082.en; Cassandra L. Rigby et al., *Mobula kuhlii*. The IUCN Red List of Threatened Species (2020), https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T161439A124485584.en.
[186] Diego Cardeñosa et al., *CITES-listed sharks remain among the top species in the contemporary fin trade.* Conservation Letters 11, no. 4 1-7 (2018).

2. NOAA Fisheries must advocate in international fora to end illegal and overfishing of sharks.

NOAA Fisheries should also leverage its position at the RMFOs to which it is a party to push for more protections for highly migratory shark species and for more robust conservation and management measures (CMMs) for sharks. Appropriate measures include: retention bans for more at-risk shark and ray species across all of the major RFMOs; finning bans that include requirements to land sharks with fins naturally attached; and compliance with CMMs that mandate observer coverage and reporting of data on shark catches as well as violations of RFMO CMMs. NOAA Fisheries should also exercise its influence with the RFMOs to push for greater transparency about vessels and nations that are engaged in IUU fishing, including with respect to sharks, and to push for meaningful penalties for violations and repeat offenders. When NOAA Fisheries fails to support much-needed conservation measures for at-risk species within international fora, as it did when the U.S. failed to back a proposed retention ban for shortfin mako at the International Commission for the Conservation of Atlantic Tunas (ICCAT) in 2020,[187] it misses crucial opportunities to set the standards for global shark conservation and to encourage other nations to adopt them.

E. NOAA Fisheries Must Prioritize Policies and Approaches to End the Illegal Trade in Shark Products

The U.S. should step up its efforts to curb the illegal trade in shark fins and other products. In addition to fishing and trading sharks in our own right, the U.S. is also an important transit hub for the international shark fin trade,[188] with fins from some of the world's top shark-fishing nations passing through U.S. ports on their way to global markets. The U.S. has both domestic and international obligations to ensure that the trade in wildlife parts is legal and sustainable, but these "in-transit" shark fin shipments—which frequently contain fins of protected, even endangered, sharks—usually slip through the cracks of U.S. law enforcement.

The U.S. has the legal authority it needs to crack down on this unseen illegal trade through our borders. NOAA Fisheries should prioritize efforts to eradicate the illegal shark fin trade and use its authority robustly to identify, inspect, and, where relevant, seize shark fin shipments in transit. In particular, NOAA Fisheries should collaborate proactively with U.S. Fish and Wildlife Service and Customs and Border Protection, as well as with state wildlife agencies, to strengthen formal partnerships to share information, develop risk-based analyses and systems to identify shark fins entering U.S. jurisdiction, conduct investigations, and monitor and inspect potential illegal shipments. By working aggressively to eradicate the illegal shark fin trade, NOAA

[187] David W. Sims et al., *Shortfin mako sharks speeding to the brink*. 371 Science 355 (2021).
[188] Elizabeth Murdock and Vanessa Villanueva, *Unintentional Partner: How the United States Helps the Illegal Shark Fin Market*, Natural Resources Defense Council (2019); https://www.nrdc.org/resources/unintentional-partner-how-united-states-helps-illegal-shark-fin-market.

Fisheries can help to remove one of the prime stressors on global shark populations and thus help to bolster the resilience of these species around the world.

IV. Conclusion

NRDC is highly supportive of efforts by NOAA Fisheries and the Biden Administration to tackle the climate and biodiversity crises with the required urgency, and we appreciate the opportunity to provide these comments. We look forward to working with NOAA and other agencies to ensure that our fisheries and protected resources can withstand the climate-related disruptions now underway in our oceans. Our staff are happy to answer any questions and can be contacted with the information below.

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